

# Utility Interconnection Equipment Certification

The information on this form is provided to indicate the compliance of the generation equipment listed below with the utility interconnection certification requirements defined in California PUC Electric Rule 21

**Certifying Laboratory** *The information on this form is provided by the following Nationally Recognized Test Laboratory*

Laboratory: Intertek ETL Semko \_\_\_\_\_

Contact Name: Frank Serra Phone: (607) 758-6267 E-mail: frank.serra@intertek.com \_\_\_\_\_

Address: Intertek Testing labs, 3933 US RT 11 \_\_\_\_\_

City: Cortlandt \_\_\_\_\_ State: NY Zip: 13045

Accredited by: OSHA \_\_\_\_\_ Date: \_\_\_\_\_

Accredited to (test standards)<sup>1</sup>: Safety for Inverters, Converters, and Controllers for Use in Independent Power Systems, UL 1741 (First Edition, Dated May 7, 1999 including revisions up to November 7<sup>th</sup>, 2005)

**Equipment Specification** *The information on this form applies to the following equipment*

Equipment Manufacturer: Fuel Cell Energy/Satcon Power Systems \_\_\_\_\_

Address: 3 Great Pasture Road \_\_\_\_\_

City: Danbury \_\_\_\_\_ State CT \_\_\_\_\_ Zip 06813

Model Number(s): Fuel Cell Energy Inc. Model # DFC300MA using Rockwell / Allen - Bradley inverter model 21LF300XPCU

Software Version(s): 1.001.01

Effective<sup>2</sup>: certification date April 25<sup>th</sup>, 2008; covered inverter Model 21LF300XPCU series, serial number GNFX20-0001-MEAH7LE7 or later.

Device Description<sup>3</sup>: The products covered by this report are Power Conditioning Modules with liquid-cooling housed within listed Type 3R enclosure that receive DC power from (external) fuel cells and converts it into 3Ø a.c. power for utility-interactive applications and intended to be permanently installed in an unclassified, indoor/outdoor location. The Maximum ambient temperature is 40°C (104°F).

The unit (based on representative sample Model No. 21LF300XPCU measures 244cm (96") wide, 107cm (42") deep, 227.5cm (89-1/2") high and weighs approximately 4,536Kg (10,000 Lbs).

The product output is intended to have a point of common coupling with the grid on load side of the building service equipment (location category B)

---

---

---

---

## **Test Results**<sup>4</sup>

Mark the box next to each requirement that has been met and each test that has been performed and successfully passed. Provide an explanation of any exceptions or omissions on a separate sheet. List additional test documents used on a separate sheet

| <b>Result</b>                       | <b>Test</b>  | <b>Standard Before 11/07/05</b>   | <b>Standard After 11/07/05</b> |
|-------------------------------------|--|-----------------------------------|--------------------------------|
| <input checked="" type="checkbox"/> | Utility Interaction  | UL1741 Sect. 39                   | IEEE1547.1 Sect. 5.2, 5.3      |
| N/A                                 | DC Isolation   | UL1741 Sect. 40.1                 | IEEE1547.1 Sect. 5.6           |
| <input checked="" type="checkbox"/> | Max. and min. input voltage  | UL1741 Sect. 41.2                 | UL1741 Sect. 41.2              |
| <input checked="" type="checkbox"/> | Dielectric Voltage Withstand                                       | UL1741 Sect. 44                   | UL1741 Sect. 44                |
| <input checked="" type="checkbox"/> | Output Ratings (included Power Factor)                             | UL1741 Sect. 45.2                 | UL1741 Sect. 45.2              |
| <input checked="" type="checkbox"/> | Harmonic (Stand-Alone)   | UL1471 Sect. 45.4.1               | UL1741 Sect. 45.4.1            |
| <input checked="" type="checkbox"/> | Harmonic (Grid Tie)  | UL1741 Sect. 45.4.2               | IEEE1547.1 Sect. 5.11          |
| N/A                                 | DC injection   | UL1741 Sect. 45.5                 | IEEE1547.1 Sect. 5.6           |
| <input checked="" type="checkbox"/> | Grid Abnormal Conditions (Utility Voltage and Frequency Variation) | UL1741 Sect. 46.2                 | IEEE1547.1 Sect. 5.2, 5.3      |
| <input checked="" type="checkbox"/> | Reconnection to Grid   | UL1741 Sect. 46.2.3               | IEEE1547.1 Sect. 5.10          |
| <input checked="" type="checkbox"/> | Anti-islanding Test  | UL1741 Sect. 46.3<br>Rule 21 J3.b | IEEE1547.1 Sect. 5.7           |
| <input checked="" type="checkbox"/> | Loss of Control Circuit  | UL1741 Sect. 46.4                 | UL1741 Sect. 46.4              |
| <input checked="" type="checkbox"/> | Short Circuit Test   | UL1741 Sect. 47.3                 | UL1741 Sect. 47.3              |
| N/A                                 | Load Transfer Test   | UL1741 Sect. 47.7                 | UL1741 Sect. 47.7              |
| <input checked="" type="checkbox"/> | Surge Withstand Capability   | Rule 21 J.3.e                     | IEEE1547.1 Sect. 5.5.2         |
| <input checked="" type="checkbox"/> | Synchronization  | Rule 21 J.3.f                     | IEEE1547.1 Sect. 5.4           |
| N/A                                 | Non-export   | Rule 21 J.3.c                     | Rule 21 J.3.c                  |
| N/A                                 | In-rush Current  | Rule 21 J.3.d                     | IEEE1547.1 Sect. 5.4.4         |
| <input checked="" type="checkbox"/> | Temperature Stability  |                                   | IEEE1547.1 Sect. 5.1           |
| <input checked="" type="checkbox"/> | RF Electromagnetic Field Immunity                                  | IEEE Std C37.90.2                 | IEEE Std C37.90.2              |

Device Rating<sup>5</sup>: Input: 300–500VDC, 1027A,

Output: 380–480V, 537A max, 353KVA / 318KW, 60Hz (3Ø)

Maximum available fault current: 2200A (for 6uS), otherwise 125% of rated max current

In-rush current<sup>6</sup>: Synchronization in-rush current 50.0A

Trip settings (Magnitude/Timing)<sup>7</sup>: (See test report for verification testing)

|                    | Factory Voltage and Frequency Setting | Factory timing Setting |
|--------------------|---------------------------------------|------------------------|
| Fast Over Voltage  | 576.0 V (120%)                        | 160msec                |
| Over Voltage       | 552.0 V (115%)                        | 1.0 sec                |
| Under Voltage      | 336.0 V (70%)                         | 2.0 sec                |
| Fast Under Voltage | 240.0 V (50%)                         | 160msec                |
| Over Frequency     | 60.50 Hz                              | 160msec                |
| Under Frequency    | 59.30 Hz                              | 160msec                |
| Min. Frequency     | 57.00 Hz                              | 160msec                |

Note: Trip settings of voltage  $50\% < V < 120\%$  and under - frequency are field adjustable.

Nominal Power Factor (Range, if adjustable) Adjustable 0.9 to 1.0 at full load \_\_\_\_\_

Non-Islanding: Yes **X** No \_\_\_ Maximum trip time: 1.066 sec

Non-Export: Yes \_\_\_ No **X** Method: \_\_\_\_\_

Other<sup>8</sup>: The Power Conditioning Module 21LF300XPCU as representative sample was tested in accordance with UL1741 (First Edition, Dated May 7, 1999 including revisions up to November 7, 2005). The sequence of tests for Utility Voltage and Frequency Variation, Synchronization and Surge Withstand Capability was done according with order of Rule 21 Table J.2 “Type Tests Sequence for Interconnection Equipment Certification”.

1. Utility Voltage and Frequency Variation Test before Surge Withstand Capability Test.  
See pages 25-36 of UL1741 test report.

Note. The measurement tolerance for settings as follow:

- For overvoltage setting 576.0 V measured level is 573.6 – 576.8 V
- for overvoltage setting 552.0 V measured level is 548.4 – 551.6 V
- for overvoltage setting 528.0 V measured level is 525.6 – 528.4 V
- for undervoltage setting 422.4 V measured level is 421.6 – 424.4 V
- for undervoltage setting 331.2 V measured level is 330.0 – 332.4 V
- for undervoltage setting 240.0 V measured level is 240.4 – 242.0 V
- for overfrequency setting 60.50 Hz measured level is 60.55 Hz
- for underfrequency setting 59.80 Hz measured level is 59.74 Hz
- for underfrequency setting 59.40 Hz measured level is 59.34 Hz
- for underfrequency setting 57.00 Hz measured level is 56.94 Hz

Note: The measurements tolerance combines the accuracy of reading of Digital Controller Board and measurement equipment used during the test.

2. Synchronization Test before Surge Withstand Capability Test.

See page 37-40 of UL1741 test report.

3. Surge Withstand Capability Test.

See page 41 of UL1741 test report.

4. Utility Voltage and Frequency Variation after Surge test

See pages 42-52 of UL 1741 test report

5. Synchronization Test after Surge Test.

See page 53-57 of UL 1741 test report.

Notes:

<sup>1</sup> Accreditation must apply to test standards listed herein.

<sup>2</sup> Note here the date of certification, applicable serial number (range or first in series), or other information that indicates to which units the certification applies.

<sup>3</sup> List appropriate functions, capabilities, applications, limitations, etc. Use additional sheets as necessary.

<sup>4</sup> List all test documents (i.e. UL 1741, IEEE C62.45) and specific procedures (i.e. UL 1741 Sec 39.1 – 39.5, etc.) used to evaluate device's suitability for utility interconnection

<sup>5</sup> For devices that use grid power to motor to speed.

<sup>6</sup> For devices that use grid power to motor to speed.

<sup>7</sup> Enter trip magnitude, Voltage in volts or frequency in Hz, and trip timing, in cycles into each square (Magnitude/Timing). Devices with adjustable settings shall provide test results over the range of settings. For each test setting provide the setting values in the upper box and measured results in the lower box. List device ranges, if adjustable. Show data for one phase (greatest % difference between setting and measured magnitudes as well as the maximum trip time for that setting). Provide data for all phases (on additional sheets) if measured trip values for any two phases differ by more than 3% (for the same setting).

<sup>8</sup> Provide any additional information that may be useful in evaluating these results such as test configurations, device settings used to meet requirements, etc. Use additional sheets if necessary.